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NATIONAL DAM SAFETY PROGRAM. SUNSHINE LAKE DAM (NJ00766), DELAW--ETC(U)
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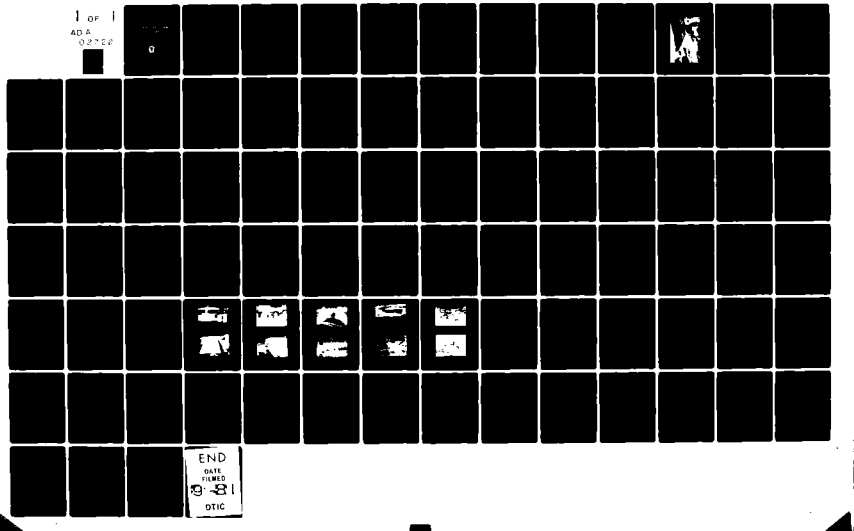
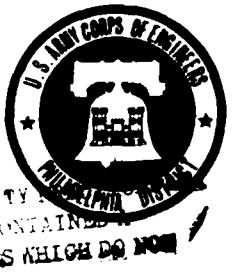


DELAWARE RIVER BASIN
BARTON RUN, CAMDEN COUNTY
NEW JERSEY

SUNSHINE LAKE DAM
NJ 00766

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

REPT. NO: DAEN/NAP- 53842/NJ 00766-81/07

JULY 1981

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

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National Dam Safety Program. Sunshine Lake Dam (NJ00766), Delaware River Basin, Barton Run, Camden County, New Jersey. Phase I Inspection Report.

18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia 22151.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams
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Visual Inspection
Structural Analysis
National Dam Safety Program
Sunshine Lake Dam, NJ
Delaware River Basin
Barton Run, N.J.
Outlet works
Seepage
Erosion

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO
NAPEN-N

31 JUL 1981

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

Dear Governor Byrne:

Included is the Phase I Inspection Report for Sunshine Lake Dam in Camden County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Sunshine Lake Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in fair overall condition. The dam's spillways are considered inadequate because a flow equivalent to 4 percent of the Spillway Design Flood (SDF) would cause the dam to be overtopped. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures and studies within six months from the date of approval of this report. Within three months of the consultant's findings remedial measures to ensure spillway adequacy should be initiated.

b. Within six months from the date of approval of this report the owner should engage a qualified professional consultant to monitor the observed possible seepage at the dam on a periodic basis in order to detect any changes in its volume or condition.

c. Within six months from the date of approval of this report the following remedial actions should be initiated:

(1) The upstream and downstream faces of the dam should be properly protected against erosion.

(2) Timber stoplogs in the outlet works should be repaired or replaced.

(3) Outlet works discharge channel walls should be repaired or reconstructed.

(4) The plywood board forming the roof of the auxiliary spillway should be repaired in such a manner as not to be hazardous.

(5) Trees and adverse vegetation on the embankment should be removed.

d. The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam, within one year from the date of approval of this report.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Florio of the First District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Inspection Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

ROGER L. BALDWIN
Lieutenant Colonel, Corps of Engineers
Commander and District Engineer

1 Incl
As stated

Copies furnished:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Regulation
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

SUNSHINE LAKE DAM (I.D. 766)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 7 January 1981 by Storch Engineers, under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Sunshine Lake Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in fair overall condition. The dam's spillways are considered inadequate because a flow equivalent to 4 percent of the Spillway Design Flood (SDF) would cause the dam to be overtopped. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures and studies within six months from the date of approval of this report. Within three months of the consultant's findings remedial measures to ensure spillway adequacy should be initiated.

b. Within six months from the date of approval of this report the owner should engage a qualified professional consultant to monitor the observed possible seepage at the dam on a periodic basis in order to detect any changes in its volume or condition.

c. Within six months from the date of approval of this report the following remedial actions should be initiated:

(1) The upstream and downstream faces of the dam should be properly protected against erosion.

(2) Timber stoplogs in the outlet works should be repaired or replaced.

(3) Outlet works discharge channel walls should be repaired or reconstructed.

(4) The plywood board forming the roof of the auxiliary spillway should be repaired in such a manner as not to be hazardous.

(5) Trees and adverse vegetation on the embankment should be removed.

d. The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam, within one year from the date of approval of this report.

APPROVED: Roger Baldwin

ROGER L. BALDWIN
Lieutenant Colonel, Corps of Engineers
Commander and District Engineer

DATE: 31 July 81

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Sunshine Lake Dam, I.D. NJ00766
State Located:	New Jersey
County Located:	Camden
Drainage Basin:	Delaware River
Stream:	Barton Run
Date of Inspection:	January 7, 1981

Assessment of General Condition of Dam

Based on visual inspection, past operational performance and Phase I engineering analyses, Sunshine Lake Dam is assessed as being in fair overall condition.

Based on investigations of the downstream flood plain made in connection with this report, it is recommended that the hazard potential classification be downgraded from high to significant hazard.

Hydraulic and hydrologic analyses indicate that the spillways are inadequate. Discharge capacity of the spillways is not sufficient to pass the designated spillway design flood (100-year storm) without an overtopping of the dam. The spillway are capable of passing approximately 3 percent of the spillway design flood. Therefore, the owner should engage a professional engineer experienced in the design and construction of dams in the near future to perform more accurate hydraulic and hydrologic analyses relating to spillway capacity. Based on the findings of the analyses, the need for and type of remedial measures should be determined and then implemented.

Observed possible seepage at the dam should be monitored on a periodic basis by an engineer experienced in the design and construction of dams in order to detect any changes in its volume or condition.

In addition, it is recommended that the following remedial measures be undertaken by the owner in the near future.

1) The upstream and downstream faces of the dam should be properly protected against erosion.
2) Timber stoplogs in the outlet works should be repaired or replaced.
3) Outlet works discharge channel walls should be repaired or reconstructed.
4) The plywood board forming the roof of the auxiliary spillway should be repaired in such a manner as not to be hazardous.
5) Trees and adverse vegetation on the embankment should be removed.

In the future, the owner of the dam should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

Richard J. McDermott, P.E.

John E. Gribbin, P.E.

OVERVIEW - SUNSHINE LAKE DAM

31 JANUARY 1981

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that the unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydraulic and hydrologic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydraulic and hydrologic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

SUNSHINE LAKE DAM, I.D. NJ00766

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The Division of Water Resources of the New Jersey Department of Environmental Protection (NJDEP) in cooperation with the Philadelphia District of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the State of New Jersey. Storch Engineers has been retained by the NJDEP to inspect and report on a selected group of these dams. The NJDEP is under agreement with the Philadelphia District of the Corps of Engineers.

b. Purpose of Inspection

The visual inspection of Sunshine Lake Dam was made on January 7, 1981. The purpose of the inspection was to make a general assessment of the structural integrity and operational adequacy of the dam structure and its appurtenances.

1.2 Description of Project

a. Description

Sunshine Lake Dam is an earth embankment with a principal spillway, auxiliary spillway and an outlet works. The principal spillway consists of a rectangular concrete chute located at the left end of the dam and discharging into a small lake located immediately downstream from subject dam. The auxiliary spillway consists of a drop inlet located near the right end of the dam and discharging through a 12-inch concrete culvert into the above mentioned downstream lake.

The outlet works consists of a rectangular dishcarge channel formed by concrete and cinder block walls which transversely penetrate the dam. Flow through the discharge channel is controlled by timber stoplogs which also serve as an additional auxiliary spillway.

The elevation of the principal spillway crest is 117.8, National Geodetic Vertical Datum (N.G.V.D.). The elevation of the auxiliary spillway crest is at 118.0 while that of the outlet works (top of stoplogs) is 118.2. The crest of the dam is at elevation 119.9 and the downstream channel bed elevation is 110.3. The overall length of the dam is 430 feet and its height is 9.6 feet.

b. Location

Sunshine Lake Dam is located in Voorhees Township, Camden County, New Jersey. The dam is situated about 500 feet west of Cooper Road about one half mile north of its intersection with N.J. Route 73. Discharge from the spillway of the dam flows into Barton Run.

Sunshine Lake is located immediately upstream of Sunshine Lakes Swimming Club Pond (apparently abandoned) within a development entitled Alluvium-Phase III as recorded with Voorhees Township. Principal access to the dam is via Cooper Road about one-half mile north of its intersection with NJ Route 73.

c. Size and Hazard Classification

The dam is classified in accordance with criteria presented in "Recommended Guidelines for Safety Inspection of Dams" published by the U.S. Army Corps of Engineers. Size categories consist of Small, Intermediate and Large while hazard categories are designated as Low, Significant and High.

Size Classification: Sunshine Lake Dam is classified as "Small" size since its maximum storage volume is 50 acre-feet (which is less than 1000 acre-feet) and its height is 9.6 feet (which is less than 40 feet).

Hazard Classification: Visual inspection of the downstream flood plain of the dam indicates that failure of the dam could result in damage to public road bridges located 700 feet and 1000 feet from the dam. In addition, failure of the dam could cause overtopping of the dam located 300 feet downstream and partial inundation of 2 dwellings located 900 feet from the subject dam. Loss of more than a few lives is not anticipated. Accordingly, Sunshine Lake Dam is classified as "Significant" hazard.

d. Ownership

Sunshine Lake Dam is privately owned by the Canetic Corp. All correspondence should be addressed to Canetic Corp., Box 41, Berlin, New Jersey.

e. Purpose of Dam

The purpose of the dam is the impoundment of a recreational lake facility.

f. Design and Construction History

Sunshine Lake Dam was constructed around 1933 for the purpose of containing a water supply pond for a private swimming pond located immediately downstream. According to an inspection report found in the NJDEP Dam File #31-81, dated 12/24/40, Sunshine Lakes consisted of four bodies of water including the following: 1) the swimming pond, 2) the supply pond (subject dam) 3) the upper cranberry bog and 4) the lower cranberry bog. The flood of September 1, 1940 caused the upper and lower cranberry bogs to breach and the probable overtopping of the westerly banks of the supply pond. This in turn caused Cedar Lake Dam, located 1 mile downstream, to breach.

The present owner acquired title to the entire Sunshie Lakes tract in 1972 and a public swimming facility was maintained at the swimming pond until termination in 1975.

The supply pond, impounded by Sunshine Lake Dam has changed since its construction in or around 1933. It appears that the original spillway configuration changed with the addition of the existing principal spillway. In addition, the shoreline of the impoundment has changed somewhat. It is not known when or how these changes were made.

g. Normal Operational Procedures

The dam and its appurtenances have not been maintained or operated in recent years. No operation or maintenance records could be obtained.

1.3 Pertinent Data

a.	Drainage Area	1.9 square miles
b.	Discharge at Damsite	
	Maximum flood at damsite	September 1, 1940 (quantity of flow unknown)
	Outlet Works at pool elevation	25 cfs.
	Spillway capacity at top of dam	49 cfs
c.	Elevation (N.G.V.D.)	
	Top of Dam	119.9
	Maximum pool-design surcharge	121.1
	Primary spillway crest	117.8
	Secondary spillway crest	118.0
	Top of stoplogs (outlet works)	118.2
	Stream bed at centerline of dam	110.3
	Maximum tailwater	117 (Estimated)
d.	Reservoir	
	Length of maximum pool	1000 feet (Estimated)
	Length of recreation pool	800 feet (Scaled)
e.	Storage (Acre-feet)	
	Recreation pool	25
	Design surcharge	73
	Top of dam	50
f.	Reservoir Surface (acres)	
	Top of dam	18.3 (Estimated)

Maximum pool - design surcharge	21.2 (Estimated)
Recreation pool	9.2

g. Dam

Type	Earthfill
Length	430 feet
Height	9.6 feet
Sideslopes - Upstream	1 horiz. to 1 vert.
- Downstream	2 horiz. to 1 vert.
Zoning	Unknown
Impervious core	Unknown
Cutoff	Unknown
Grout curtain	Unknown

h. Diversion and Regulating Tunnel — N.A.

i. Principal Spillway

Type	Concrete Chute
Length of weir - Primary	4.4 feet
Crest elevation - Primary	117.8
Gates	N.A.
Approach channel	N.A.
Discharge channel	Concrete Chute

j. Auxiliary Spillway

Type	Drop Inlet
Length of weir	3.1 feet
Crest elevation	118.0
Gates	N.A.
Approach channel	N.A.
Discharge channel	12-inch RCP

k. Auxiliary Spillway (Outlet Works)

Type	Controlled weir (Stoplogs)
Length of weir	1.9 feet
Crest elevation	118.2
Invert elevation	113.2
Gates	Timber stoplogs
Approach channel	N.A.
Discharge channel	Rectangular channel formed by concrete and cinder block walls

l. Regulating Outlet

Timber stoplogs 1.9 feet long.

SECTION 2: ENGINEERING DATA

2.1 Design

No plans or calculations pertaining to the original construction of the dam could be obtained.

2.2 Construction

No data or reports pertaining to the construction of the dam are available.

2.3 Operation

No data or reports pertaining to the operation of the dam are available.

2.4 Evaluation

a. Availability

There is no available engineering data pertaining to the original construction of the dam.

b. Adequacy

Available engineering data pertaining to Sunshine Lake Dam is not adequate to be of significant assistance to the performance of a Phase I evaluation. A list of absent information is included in paragraph 7.1.b.

c. Validity

The validity of engineering data cannot be assessed due to the absence of data.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

The inspection of Sunshine Lake Dam was performed on January 7, 1981 by staff members of Storch Engineers. A copy of the visual inspection check list is contained in Appendix 1. The following procedures were employed for the inspection:

1) The embankment of the dam, appurtenant structures and adjacent areas were examined.
2) The embankment and accessible appurtenant structures were measured and key elevations determined by surveyor's level.
3) The embankment, appurtenant structures and adjacent areas were photographed.
4) The downstream flood plain was toured to evaluate downstream development and restricting structures.

b. Dam

A lake was located immediately downstream from the dam embankment and the lower lake appeared to be almost completely drained at the time of our inspection. The crest of the dam appeared to be fairly uniform and grass covered. The upstream face of the dam was covered with grass, briars, bushes and a few trees while the downstream face of the dam was covered with grass and trees. The tree caliper ranged from 6 to 8 inches. Erosion was observed to the right of the auxiliary spillway discharge channel both on the upstream and downstream faces of the dam. No stabilization was evident at these locations. Also erosion ruts were observed on the upstream face of the dam probably

due to pedestrian activity. Trees on the downstream side appeared to be partially buried indicating the addition of fill since the original embankment construction.

c. Appurtenant Structures

The concrete surfaces of the principal spillway were in generally satisfactory condition. The earth discharge channel was significantly eroded on its sides and bottom.

The auxiliary spillway located near the right end of the dam was mostly submerged but appeared to be in fair condition. The roof of the drop inlet consisted of a plywood board which appeared to be weak and in poor condition and should be replaced. The outlet end of the concrete discharge culvert appeared to be in satisfactory condition although no headwall or other stabilization was observed. A concrete and cinder block wall (or weir) located immediately downstream from the pipe was in deteriorated condition.

The concrete surfaces of the outlet works were in generally satisfactory condition. However, a vertical crack (1/8-inch wide) was observed in the center of the right wall in both the concrete and cinder block portions. Also, the cinder block portion of the left wall was leaning right approximately 4 inches. The timber stoplogs appeared generally sound although they were leaking around their edges.

d. Seepage

Orange deposits were observed immediately downstream from the 12-inch outlet pipe for the auxiliary spillway which could possibly be evidence of seepage. In addition, a wet area was observed at the toe of the dam to the right of the primary spillway. The wet area could be due to seepage.

e. Reservoir Area

The impoundment of the dam is irregular in shape and is 800 feet long with a width varying from 400 to 1200 feet. The right shore is wooded while the remaining shores are grass covered. Shore slopes are flat.

f. Downstream Channel

The dam discharges directly into a small lake formerly used for swimming but drained at the time of inspection. An earth dam is located at the downstream end of the small lake. Downstream from the dam, a natural channel conveys the discharge. The channel has partly wooded and partly open banks about 8 feet high within 1000 feet of the subject dam.

Paved roadways cross the channel 700 feet and 1000 feet downstream from the subject dam. Two dwellings are located 900 feet downstream from the subject dam.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

The level of water in Sunshine Lake is regulated by discharge through the principal spillway, secondary spillway and over the stoplogs of the outlet works. The outlet works of the dam can be used to drain the lake or to augment the discharge capacity of the spillways. Reportedly, the outlet works is not utilized during periods of heavy rain.

4.2 Maintenance of the Dam

Reportedly, maintenance is performed on an "as needed" basis only. The lake was last drawndown in 1978 for the purpose of dredging and reshaping the reservoir banks. Reportedly no work on the dam embankment or spillway was accomplished at this time. Reportedly, the drawdown of the lake was approved by Voorhees Township.

4.3 Maintenance of Operating Facilities

Reportedly, maintenance of operating facilities is performed on an "as needed" basis.

4.4 Description of Warning System

Reportedly, no warning system is currently in use for the dam.

4.5 Evaluation of Operational Adequacy

The operation of the dam has been successful to the extent that the dam reportedly has not been overtopped since the flood of September 1, 1940.

Areas of maintenance that have not been adequately performed are:

1) Upstream and downstream face eroded near the principal spillway and not repaired.
2) Erosion ruts observed along the upstream face of the dam not repaired.
3) Erosion of downstream embankment at 12-inch auxiliary spillway discharge pipe not stablized.
4) Timber stoplogs of outlet works leaking and not repaired.
5) Leaning left wall of outlet works not repaired or replaced.
6) Vertical crack in right discharge channel wall of outlet works not repaired.
7) Plywood board forming roof of auxiliary spillway in poor condition and not repaired.
8) Trees, weeds and brush on embankment not removed.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

The quantity of storm water runoff that the spillway should be able to handle is based on the size and hazard classification of the dam. This runoff quantity, called the spillway design flood (SDF) is described in terms of return frequency or probable maximum flood (PMF) depending on the extent of the dam's size and potential hazard. According to the "Recommended Guidelines for Safety Inspection of Dams" published by the U.S. Army Corps of Engineers, the SDF for Sunshine Lake Dam falls in a range of 100-year frequency to 1/2 PMF. In this case, the low end of the range, 100-year frequency, is chosen since the factors used to select hazard classification are on the low side of their respective range.

The SDF peak computed for Sunshine Lake Dam is 1479 c.f.s. This value is derived from the 100-year flood hydrograph computed by the use of the HEC-1-DAM Flood Hydrograph Computer Program using the Soil Conservation Service triangular unit hydrograph with curvilinear transformation. Hydrologic computations and computer output are contained in Appendix 4.

The spillway discharge rates were computed by the use of weir formulae and culvert discharge charts appropriate for the configurations of the spillways. The combined spillway discharge with lake level equal to the top of the dam was computed to be 49 c.f.s. The SDF was routed through the dam by use of the HEC-1-DAM computer program using the modified Puls Method. In routing the SDF, it was found that the dam crest would be

overtopped by a depth of 1.2 feet. Accordingly, the subject spillways are assessed as being inadequate in accordance with criteria developed by the U.S. Army Corps of Engineers.

b. Experience Data

Reportedly, the dam has not been overtopped since the flood of September 1, 1940. No damage to downstream structures has been reported.

c. Visual Observation

No significant evidence of overtopping of the embankment was noted at the time of inspection.

d. Overtopping Potential

As indicated in paragraph 5.1.a. a storm of magnitude equal to the SDF would cause overtopping of the dam by a depth of 1.2 feet over the crest of the dam. The spillway is capable of passing approximately 3 percent of the SDF with the lake level equal to the top of dam.

e. Drawdown Data

Drawdown of the lake is accomplished by removing stoplogs from the outlet works. Total time for drawdown is estimated to be approximately 13 hours. (See Appendix 4.)

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The dam appeared, at the time of inspection to be outwardly stable. No evidence of possible embankment distress was noted at the time of inspection. Possible seepage was observed near the 12-inch RCP outlet for the secondary spillway and on the downstream face of the dam near the principal spillway. The severity of the seepage cannot be precisely determined within the scope of this Phase I evaluation. However, the seepage did not appear to be an indiction of immediate structural instability.

b. Generalized Soils Description

The generalized soils description of the dam site consists of recent alluvium characterized by a poorly drained swampy condition overlying stratified deposits of marine origin composed predominantly of silty sand and narrowly graded sand. The sand deposits are shown as Cohansey Sand on the Geologic Map of New Jersey.

c. Design and Construction Data

Analysis of structural stability and construction data for the embankment are not available.

d. Operating Records

No operating records are available for the dam. The water level of Sunshine Lake is not monitored.

e. Post-Construction Changes

It appears the spillway configuration as described in the NJDEP file has changed with the addition of the present principal (concrete chute) spillway. It is not known when this work was completed. Also, evidence was noted at the time of inspection that additional fill has been added to the downstream side of the embankment since its original construction.

f. Seismic Stability

Sunshine Lake Dam is located in Seismic Zone 1 as defined in "Recommended Guidelines for Safety Inspection of Dams" which is a zone of very low seismic activity. Experience indicates that dams in Seismic Zone 1 will have adequate stability under seismic loading conditions if they have adequate stability under static loading conditions. Sunshine Lake Dam appeared to be stable under static loading conditions at the time of inspection.

SECTION 7: ASSESSMENT AND RECOMMENDATIONS

7.1 Dam Assessment

a. Safety

Based on hydraulic and hydrologic analyses outlined in Section 5 and Appendix 4, the spillways of Sunshine Lake Dam are assessed as being inadequate. The spillways are not able to pass the SDF without an overtopping of the dam.

The embankment appeared, at the time of inspection, to be outwardly stable. Evidence of possible seepage and distress in the outlet works discharge channel walls did not appear to be indications of immediate instability.

b. Adequacy of Information

Information sources for this report include 1) field inspections, 2) USGS quadrangle, and 3) files of the NJDEP, and 4) consultation with personnel of the Canetic Corporation. The information obtained is sufficient to allow a Phase I assessment as outlined in "Recommended Guidelines for Safety Inspection of Dams."

Some of the absent data are as follows:

1. Construction and as-built drawings.
2. Description of fill material for embankment.
3. Design computations and reports.
4. Maintenance documentation.
5. Soils report for the site.
6 Post construction engineering reports.

c. Necessity for Additional Data/Evaluation

Although some data pertaining to Sunshine Lake Dam are not available, additional data are not considered imperative for this Phase I evaluation.

7.2 Recommendations

a. Remedial Measures

Based on hydraulic and hydrologic analyses outlined in paragraph 5.1.a, the spillways are considered to be inadequate. It is therefore recommended that a professional engineer experienced in the design and construction of dams be engaged in the near future to perform more accurate hydraulic and hydrologic analyses relating to spillway capacity. Based on the findings of these analyses, the need for and type of remedial measures should be determined and then implemented.

In addition, it is recommended that the following remedial measures be undertaken by the owner in the near future.

1) The upstream and downstream faces of the dam should be properly protected against erosion.
2) Timber stoplogs in the outlet works should be repaired or replaced.
3) Outlet works discharge channel walls should be repaired or reconstructed.
4) The plywood board forming the roof of the auxiliary spillway should be repaired in such a manner as not to be hazardous.
5) Trees and adverse vegetation on the embankment should be removed.

b. Maintenance

In the future, the owner of the dam should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

c. Additional Studies

Observed possible seepage at the dam should be monitored on a periodic basis by an engineer experienced in the design and construction of dams in order to detect any changes in its volume or condition.

PLATES

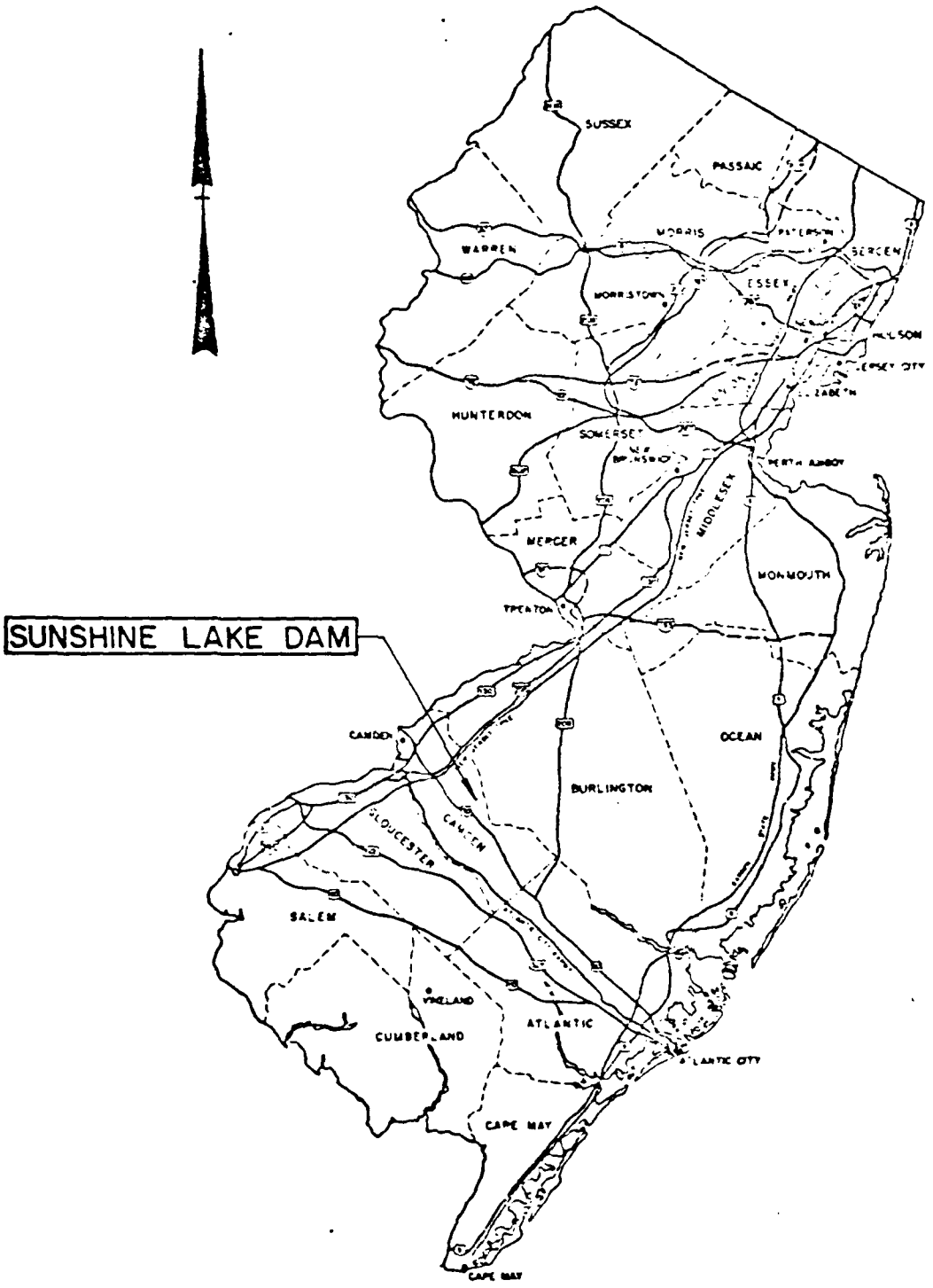
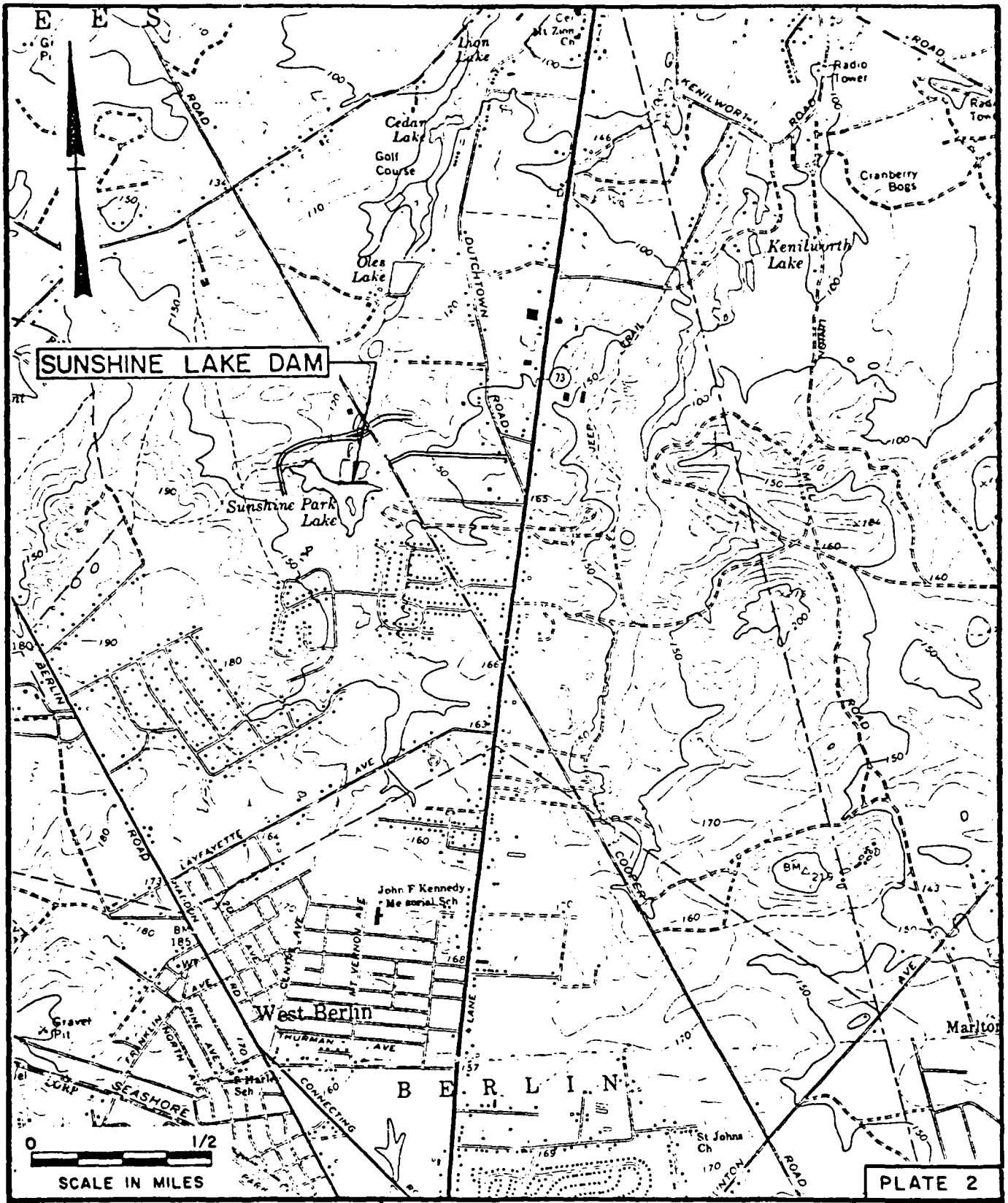


PLATE 1

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	INSPECTION AND EVALUATION OF DAMS KEY MAP SUNSHINE LAKE DAM
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	I.D. N.J. 00766 — SCALE: NONE DATE: APRIL, 1981



STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

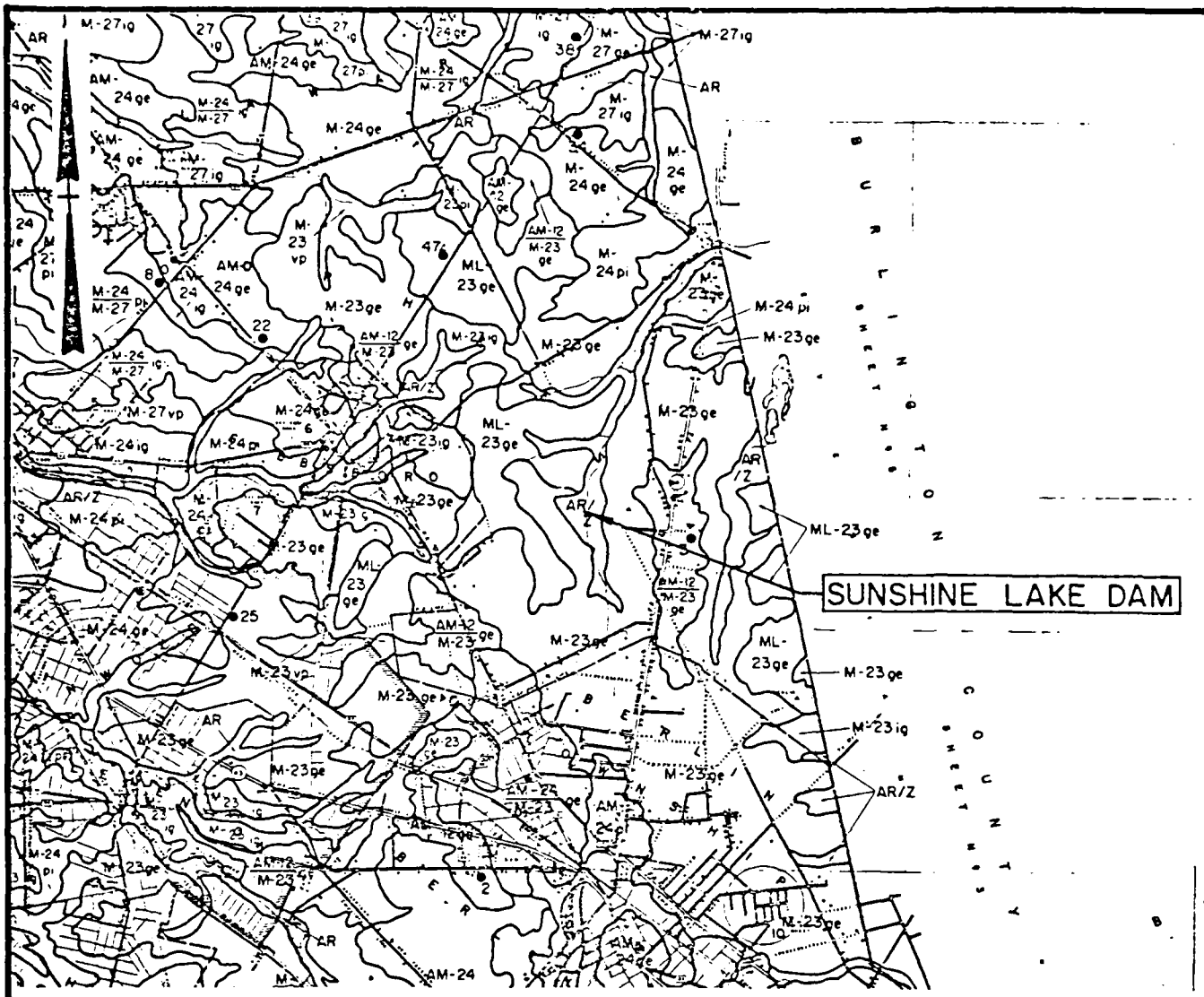
DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

VICINITY MAP

SUNSHINE LAKE DAM

I.D. N.J. 00766	SCALE: AS SHOWN
	DATE: APRIL, 1981



Legend

M-23 — Stratified deposits of marine origin composed predominantly of silty sand and narrowly grade

AR/Z — Recent alluvial deposits characterized by a poorly drained swampy condition.

Note: Information taken from Rutgers University, Soil Survey of New Jersey, Report No. 17, Camden County, and Geologic Map of New Jersey prepared by J.V. Lewis and H. Kummel 1910-1912, revised by H.B. Kummel 1931 and M. Johnson 1950.

PLATE 3

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY.

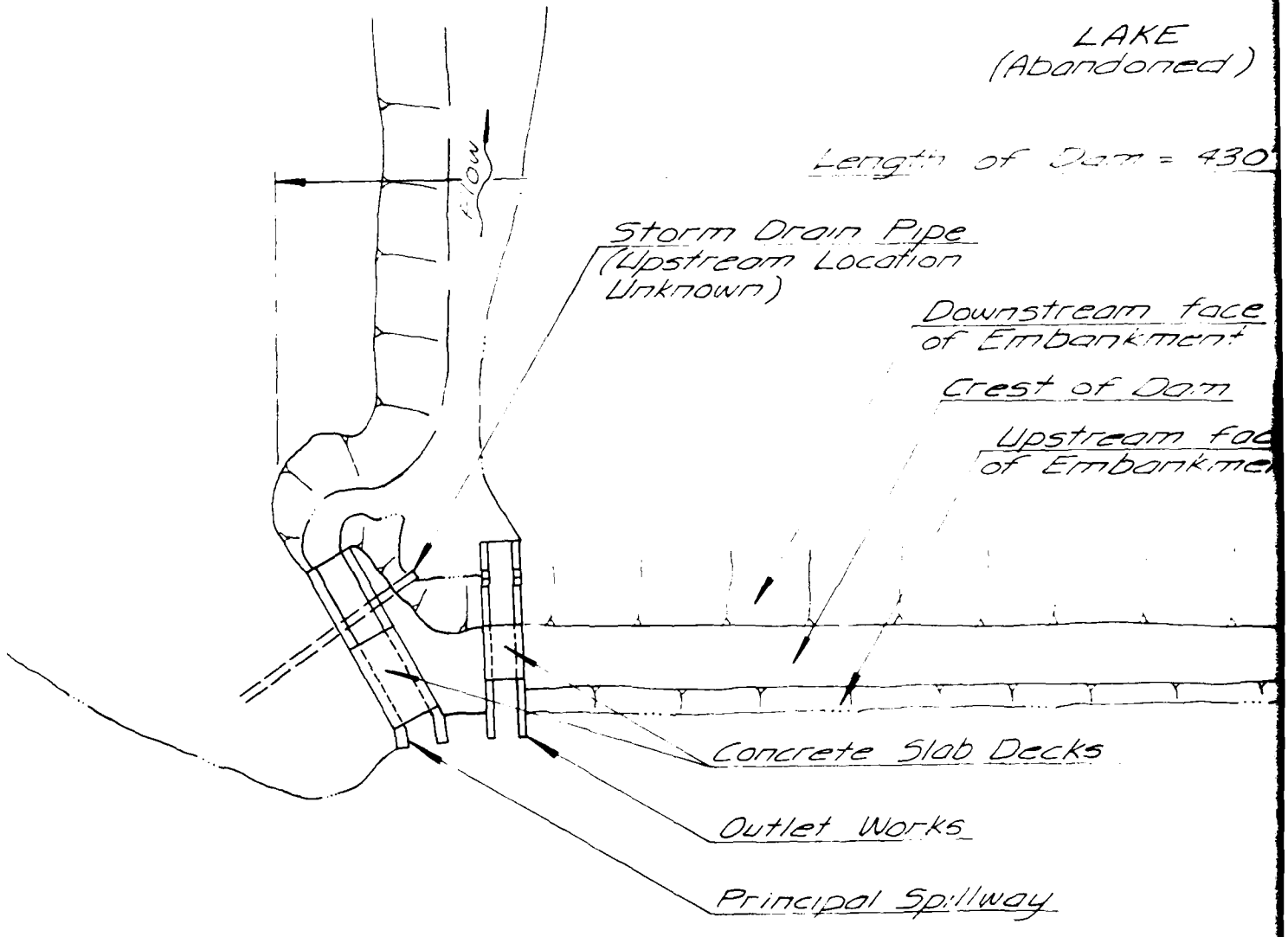
DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY.

INSPECTION AND EVALUATION OF DAMS

SOIL MAP

SUNSHINE LAKE DAM

I.D. N.J. 00766	SCALE: NONE
	DATE: APRIL, 1981


LAKE
(Abandoned)
Length of Dam = 430'
Storm Drain Pipe
(Upstream Location
Unknown)
Downstream face
of Embankment
Crest of Dam
Upstream face
of Embankment
Concrete Slab Decks
Outlet Works
Principal Spillway

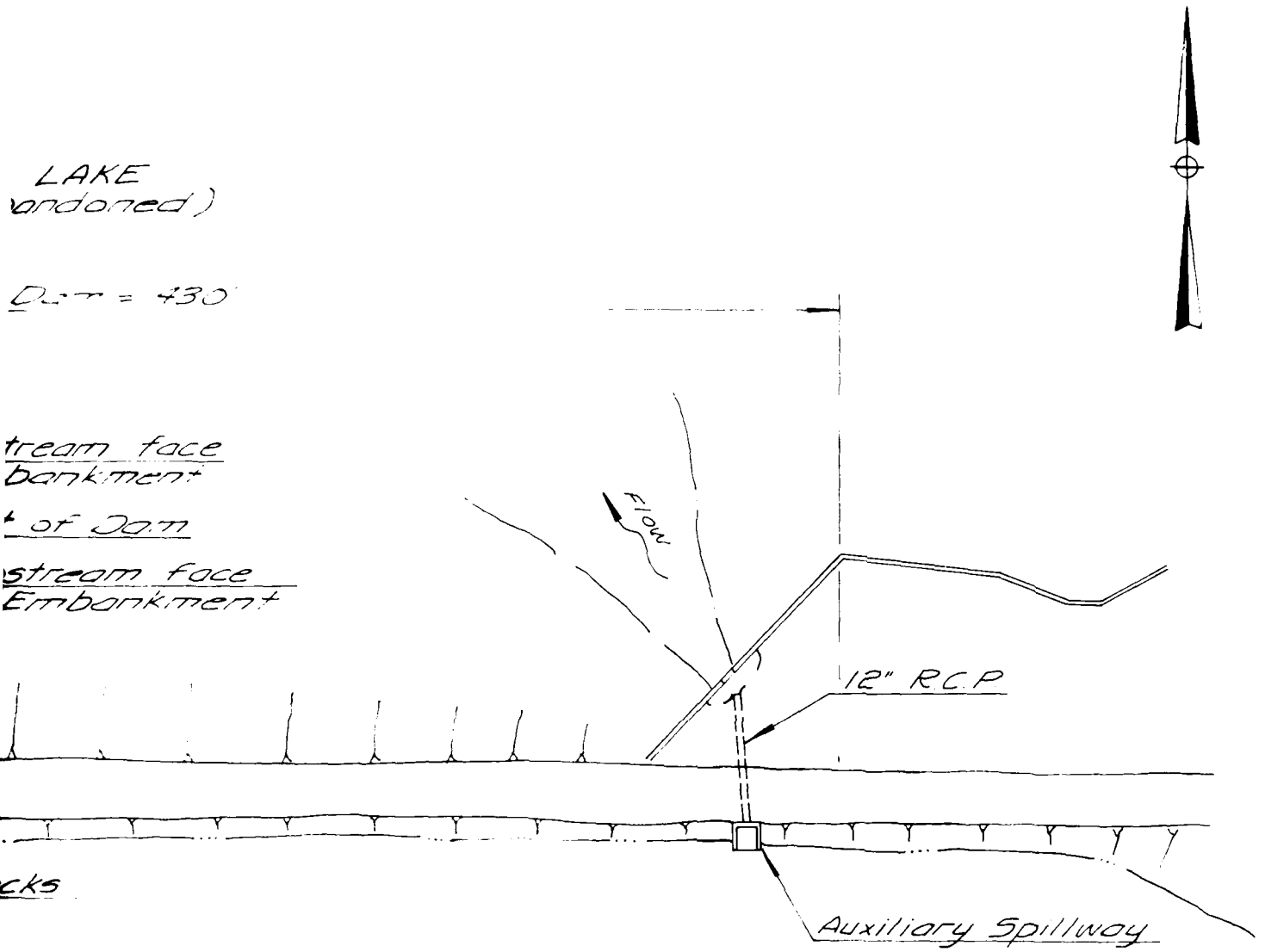


PLATE 4

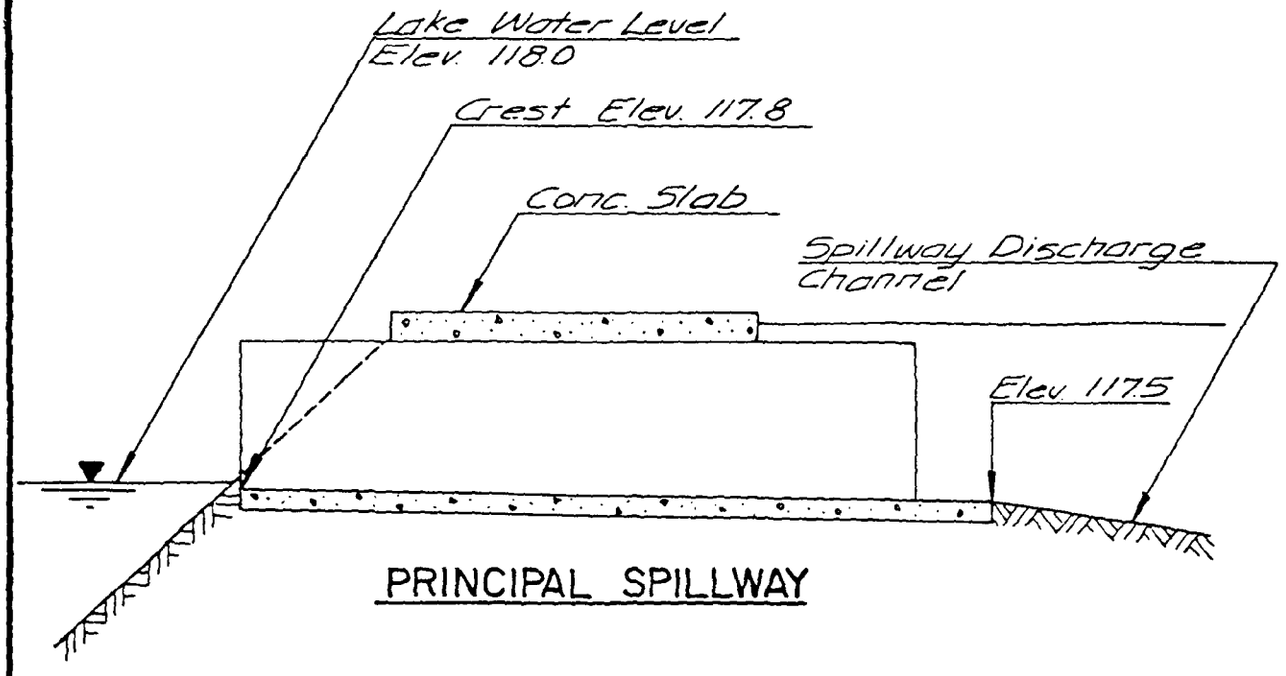
STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

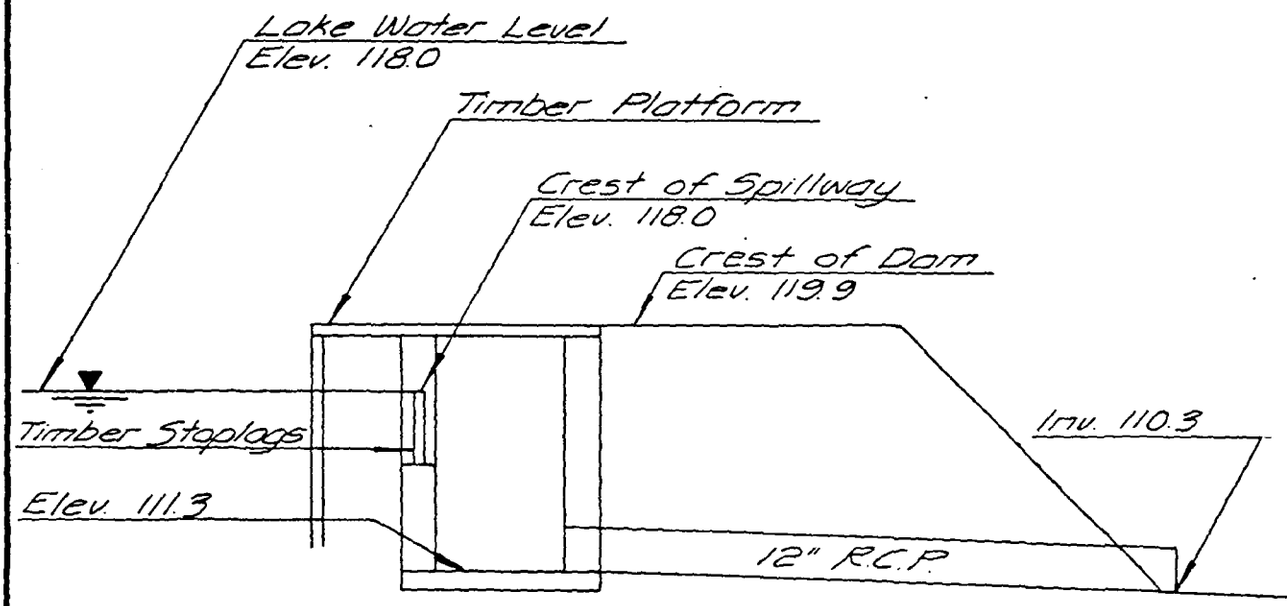
GENERAL PLAN

SUNSHINE LAKE DAM

I.D N.J. C0766	SCALE: NOT TO SCALE
	DATE: MAY, 1981



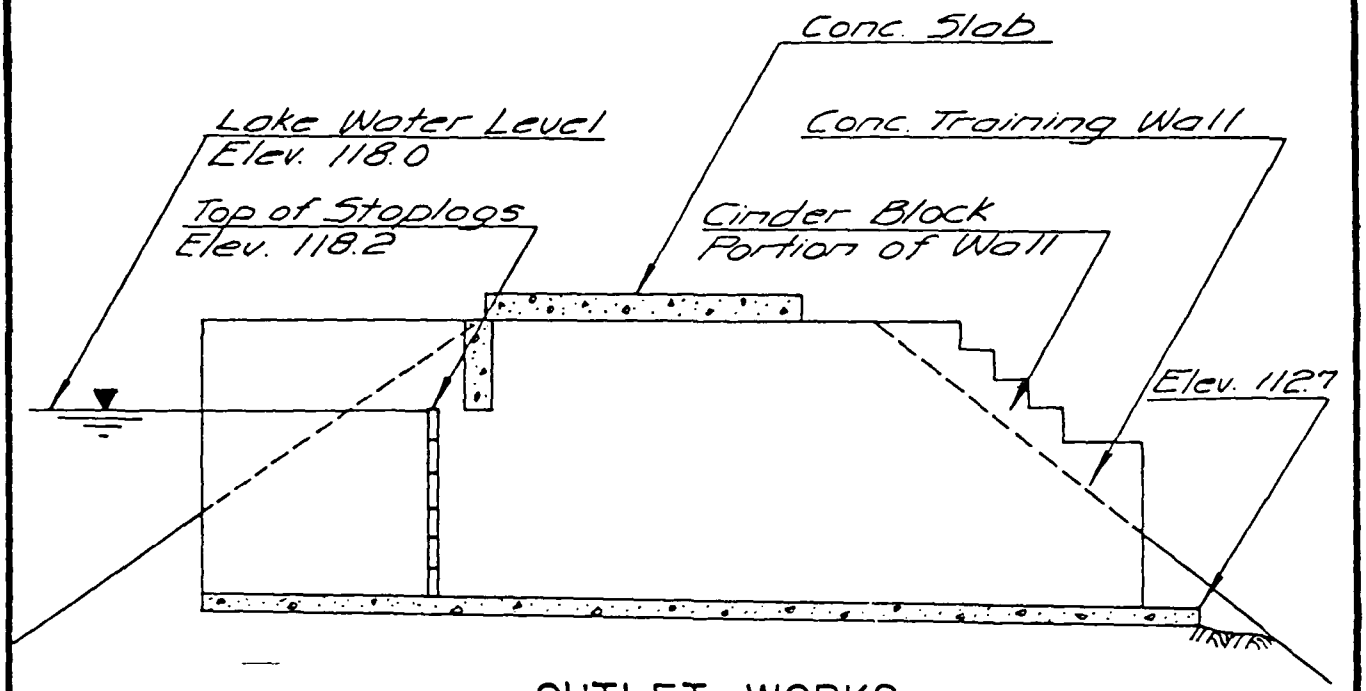
PRINCIPAL SPILLWAY



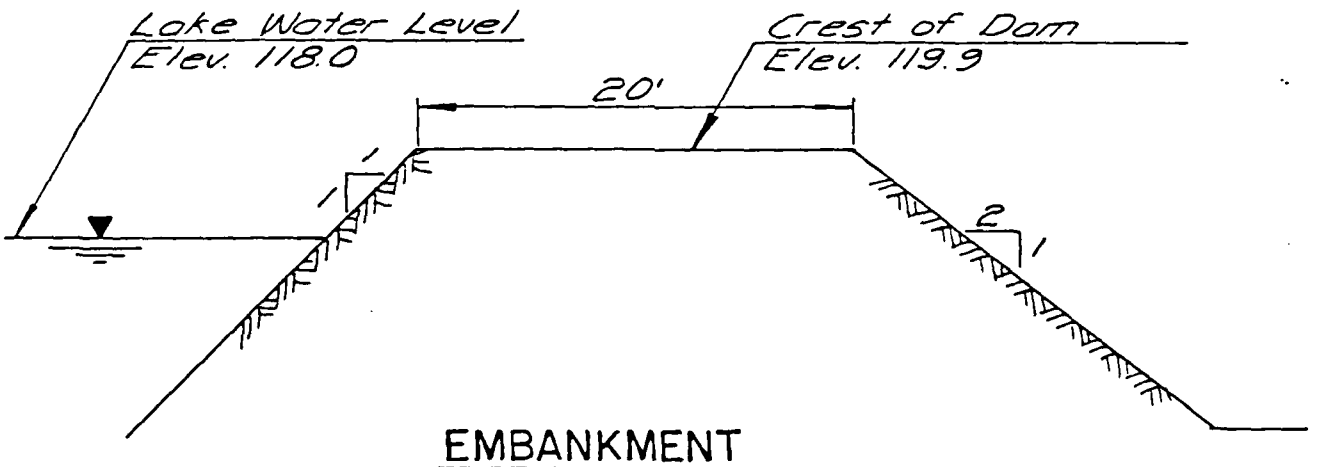
AUXILIARY SPILLWAY

PLATE 5

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	INSPECTION AND EVALUATION OF DAMS SPILLWAY SECTIONS SUNSHINE LAKE DAM
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	I.D. N.J. 00766 / SCALE: NONE DATE: MAY, 1981



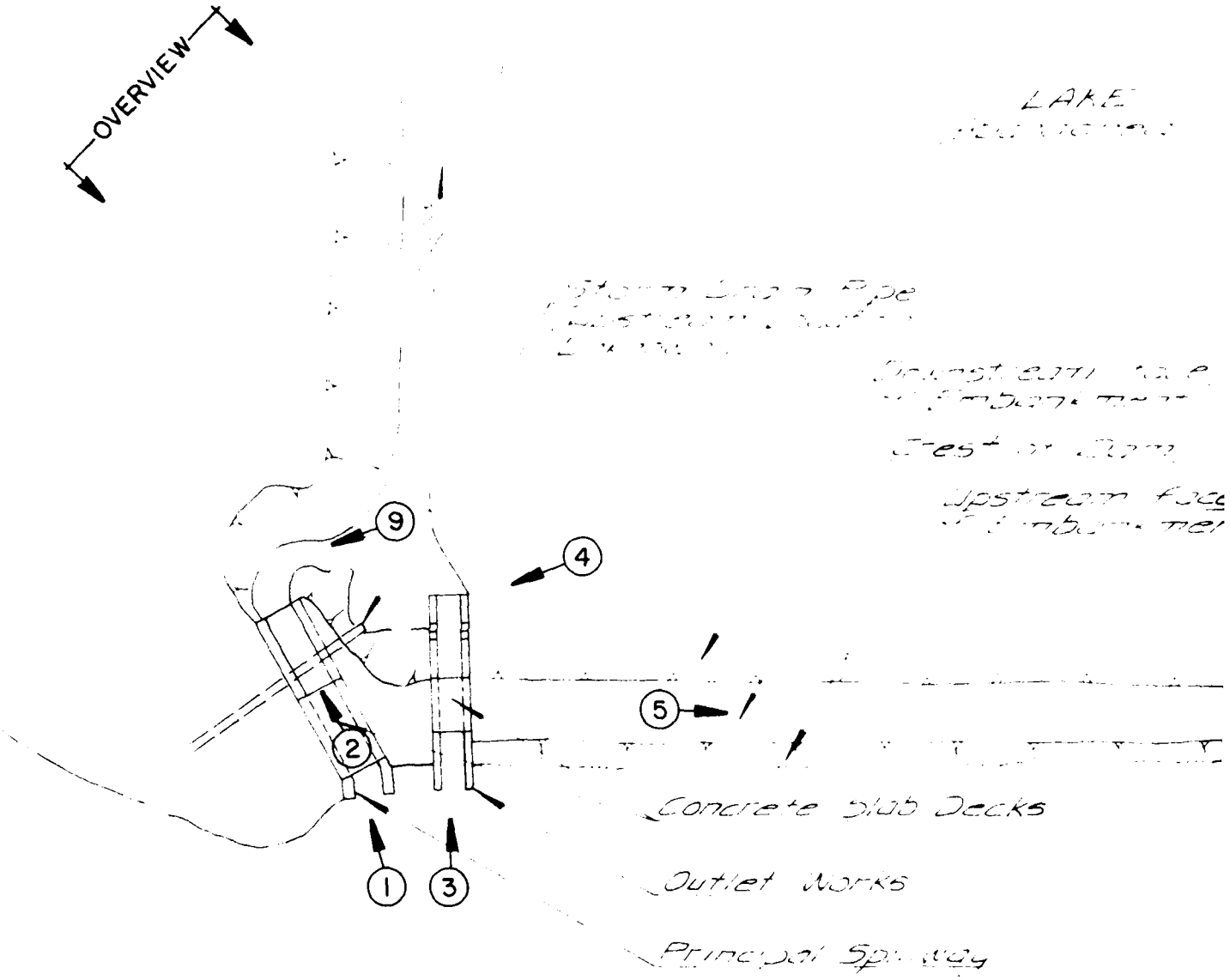
OUTLET WORKS



EMBANKMENT

PLATE 6

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	INSPECTION AND EVALUATION OF DAMS SECTIONS SUNSHINE LAKE DAM
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	I.D. N.J. 00766 / SCALE: NONE DATE: MAY, 1981


OVERVIEW
LAKE
9
4
5
2
1
3
Concrete Slab Decks
Outlet Works
10

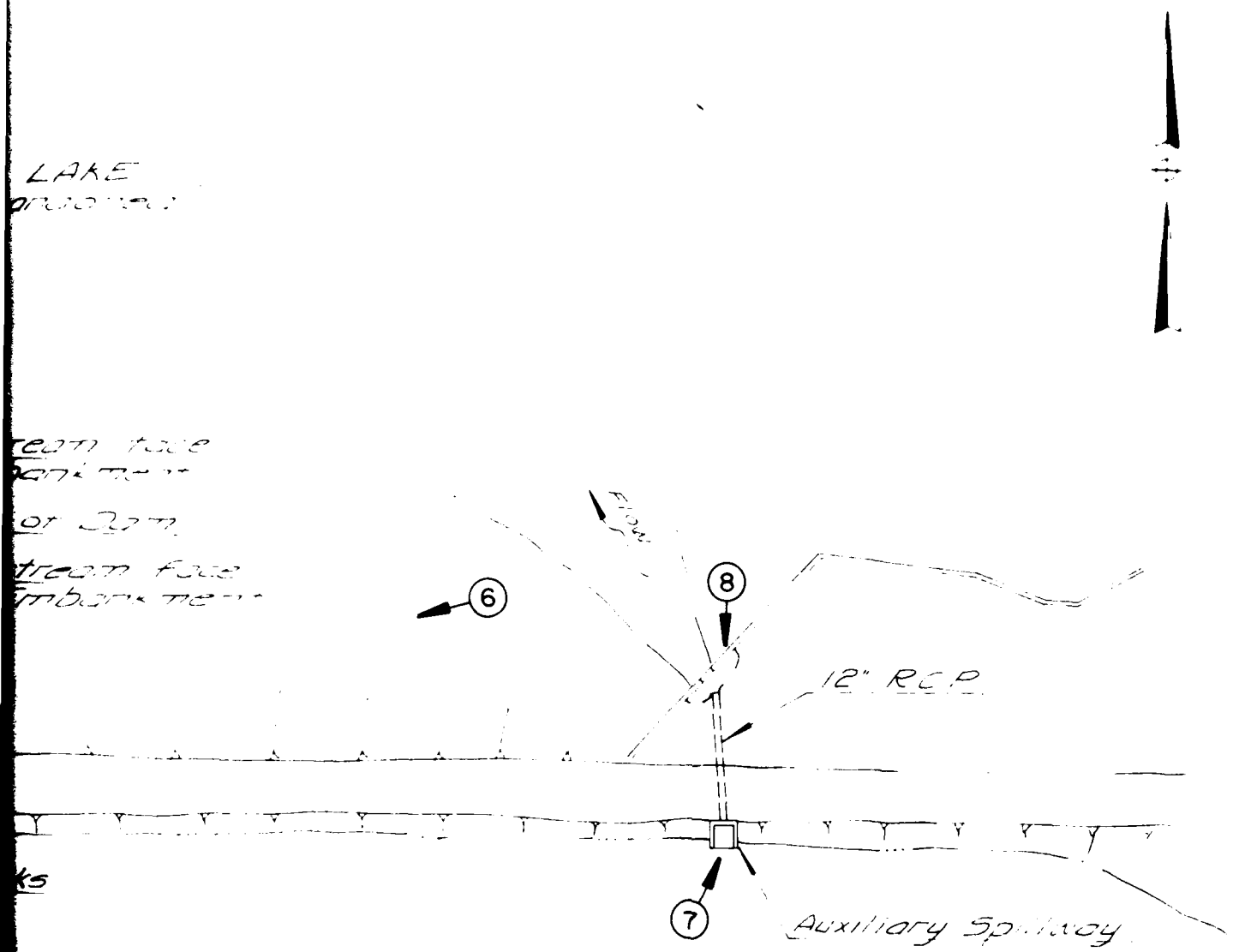


PLATE 7

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

PHOTO LOCATION PLAN

SUNSHINE LAKE DAM

ID NJ 00766	SCALE NOT TO SCALE
	DATE MAY, 1981

APPENDIX 1

Check List - Visual Inspection

Check List - Engineering Data

Check List

Visual Inspection

Phase I

Name of Dam Sunshine Lake Dam County Camden State N.J. Coordinators NJDEP

Date(s) Inspection 1/7/81 Weather Sunny, windy Temperature 15°F.

Pool Elevation at time of Inspection 118.0 M.S.L. Tailwater at Time of Inspection 113.0 M.S.L.

Inspection Personnel:

John Gribbin John Powanda

Daniel Buckelew Richard McDermott

Mark Brady

John Gribbin Recorder

Representative of Canetic Corp. interviewed on site

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
GENERAL	Crest grass covered. Downstream face covered with grass, bushes and trees (6"-8"). Upstream face covered with grass, briers, bushes and trees. Trees on downstream side appeared to be partially buried indicating that additional fill had been placed on embankment.	Trees should be removed.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Generally sound with some erosion observed. Junction at left end of dam eroded by discharge from primary spillway. Embankment surface eroded along right side of outlet works due to surface runoff.	Erosion should be filled and embankment stabilized.
ANY NOTICEABLE SEEPAGE	Wet area observed at toe near primary spillway discharge channel. Orange colored deposits noted in stream running from auxiliary spillway.	Further study needed to determine whether wet area is due to seepage.
STAFF GAGE AND RECORDER	None observed.	
DRAINS	Concrete storm drain observed running beneath principal spillway chute and discharging at downstream side of dam. Intake end could not be located.	

EMBANKMENT

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Erosion observed on upstream face possibly due to pedestrian use. Erosion observed at left abutment and at outlet works (see Junctjon).	*Upstream face should be stabilized.*
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Vertical: generally level. Horizontal: slightly curved.	
RIPRAP	None observed.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SURFACES IN OUTLET CONDUIT	Concrete surfaces generally in satisfactory condition. Vertical crack (1/8" wide) observed in center of right wall in both concrete and cinder block portions. Downstream portion of left cinder block wall leaning right approx. 4".	Lower portion of walls formed by concrete and upper portion by cinder blocks.
INTAKE STRUCTURE	N.A.	
OUTLET STRUCTURE	N.A.	
OUTLET CHANNEL	Outlet works discharge into discharge channel for primary spillway.	
GATE AND GATE HOUSING	Timber stoplogs appear to be generally sound although they were leaking around their edges.	Stoplogs should be renovated or replaced.

PRIMARY SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE CHUTE	Concrete surfaces generally in satisfactory condition.	
CONCRETE WALKWAY	Concrete surfaces generally in satisfactory condition.	
DISCHARGE CHANNEL	Sides and bottom are eroded. (See Junction.)	Discharge channel is an earth channel formed in the junction between dam and left abutment.

AUXILIARY SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
DROP INLET	The drop inlet composed of timber and concrete appeared to be in fair condition although most of the structure was submerged.	
TIMBER PLATFORM	The timber platform above the drop inlet was composed of plywood and appeared to be in poor condition.	The platform should be replaced.
DISCHARGE CULVERT	The discharge end of the concrete discharge culvert appeared to be in satisfactory condition. However, no headwall or other stabilization was observed at that location. A concrete and cinder block wall (or weir) immediately downstream from the pipe was in deteriorated condition.	

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None observed.	
OBSERVATION WELLS	None observed.	
WEIRS	None observed.	
PIEZOMETERS	None observed.	
OTHER		

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTION, DEBRIS, ETC.)	The dam discharges directly into a small lake formerly used for swimming but drained at the time of inspection. An earth dam is located at the downstream end of the small lake. Downstream from the dam, a natural channel conveys the discharge.	
SLOPES	Partly wooded and partly open banks about 8' high within 700' of downstream dam. Wooded banks about 3' high with flat flood plain 700' downstream and beyond.	
STRUCTURES ALONG BANKS	Paved roadways cross the channel 700' and 1000' downstream from subject dam. Earth dam located 300' downstream from subject dam. Two dwellings located 900' downstream from subject dam.	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Shore slopes are generally flat. The right shore is wooded while the remaining shores are grass covered.	
SEDIMENTATION	Unknown	
STRUCTURES ALONG BANKS	About two dwellings were observed along the right shore and a paved roadway for a recent residential development was observed along the upstream shore.	The lake is surrounded by a recently developed residential subdivision. Many homes were not yet constructed.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM			REMARKS
DAM	-	PLAN	Not Available
		SECTIONS	
SPILLWAY	-	PLAN	Not Available
		SECTIONS	
		DETAILS	
OPERATING EQUIPMENT PLANS & DETAILS			Not Available
OUTLETS	-	PLAN	Not Available
		DETAILS	
		CONSTRAINTS	
		DISCHARGE RATINGS	
HYDRAULIC/HYDROLOGIC DATA			Not Available
RAINFALL/RESERVOIR RECORDS			Not Available
CONSTRUCTION HISTORY			Available in files of NJDEP, Division of Water Resources, P.O. Box CN-029, Trenton, New Jersey
LOCATION MAP			Subdivision map entitled "Woods of Vorhees" dated 1972 available in Township of Vorhees files, Township of Vorhees, 620 Berlin Road, New Jersey, 08043

ITEM	REMARKS
DESIGN REPORTS	Not Available
GEOLOGY REPORTS	Not Available
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM INSTABILITY SEEPAGE STUDIES	Not Avialable
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Not Available
POST-CONSTRUCTION SURVEYS OF DAM	Not Avialable
BORROW SOURCES	Not Avialable

ITEM	REMARKS
MONITORING SYSTEMS	Not Available
MODIFICATIONS	Reportedly shoreline has changed since original construction in 1933 but no records available
HIGH POOL RECORDS	September 1, 1940, available in files of the NJDEP
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Not Available
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Reportedly dam last overtopped during storm of Sept. 1, 1940 available in files of NJDEP
MAINTENANCE OPERATION RECORDS	Not Avialable

APPENDIX 2

Photographs

PHOTO 1

UPSTREAM END OF PRINCIPAL SPILLWAY WITH OUTLET WORKS AT RIGHT

PHOTO 2

DOWNSTREAM END OF PRINCIPAL SPILLWAY

SUNSHINE LAKE DAM

7 JANUARY 1981

PHOTO 3

UPSTREAM END OF OUTLET WORKS WITH PRINCIPAL SPILLWAY AT LEFT

PHOTO 4

DOWNSTREAM END OF OUTLET WORKS

SUNSHINE LAKE DAM

7 JANUARY 1981

PHOTO 5
CREST OF DAM

PHOTO 6
DOWNSTREAM FACE OF DAM

SUNSHINE LAKE DAM
7 JANUARY 1981

PHOTO 7
AUXILIARY SPILLWAY DROP INLET

PHOTO 8
DOWNSTREAM END OF AUXILIARY SPILLWAY DISCHARGE CULVERT

SUNSHINE LAKE DAM
7 JANUARY 1981

7 JANUARY 1981

PHOTO 9

DOWNSTREAM END OF PRINCIPAL SPILLWAY DISCHARGE CHANNEL

31 JANUARY 1981

PHOTO 10

AERIAL VIEW OF DAM SHOWING DOWNSTREAM LAKE AND FLOOD PLAIN

SUNSHINE LAKE DAM

APPENDIX 3

Engineering Data

CHECK LIST

HYDROLOGIC AND HYDRAULIC DATA

ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Residential development and woodland

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 118.0 (25 acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): N.A.

ELEVATION MAXIMUM DESIGN POOL: 121.1

ELEVATION TOP DAM: 119.9

PRINCIPAL SPILLWAY CREST:

a. Elevation 117.8

b. Type Concrete Chute

c. Width N.A.

d. Length 4 feet

e. Location Spillover Downstream side of dam

f. Number and Type of Gates None

AUXILIARY SPILLWAY CREST:

a. Elevation 118.0

b. Type Drop Inlet

c. Width 1.0 feet

d. Length 3.1 feet

e. Location Spillover Upstream side of dam

f. Number and Type of Gates Timber stoplogs

OUTLET WORKS:

a. Type Timber stoplogs

b. Location Adjacent to Principal Spillway

c. Entrance Invert N.A.

d. Exit Invert 112.7

e. Emergency Draindown Facilities: Remove Stoplogs

HYDOMETEOROLOGICAL GAGES: None

a. Type N.A.

b. Location N.A.

c. Records N.A.

MAXIMUM NON-DAMAGING DISCHARGE:

(Lake Stage Equal to Top of Dam) 49 c.f.s.

APPENDIX 4

Hydraulic/Hydrologic Computations

STORCH ENGINEERS

Sheet 1 of 12

Project 1132-06 - SUNSHINE LAKE DAM

Made By JHA Date 4-1-81

Chkd By JG Date 4/10/81

HYDROLOGY

HYDROLOGIC ANALYSIS

THE RUNOFF HYDROGRAPH WILL BE DEVELOPED BY THE HEC-1-DAM COMPUTER PROGRAM USING THE SCS UNIT HYDROGRAPH METHOD WITH CURVILINEAR TRANSFORMATION.

DRAINAGE AREA = 1.9 SQMI

INFILTRATION DATA

INITIAL INFILTRATION = 1.5 IN

CONSTANT INFILTRATION = 0.15 IN/HOUR

TIME OF CONCENTRATION

1. [by SCS-TR 55]

OVERLAND FLOW :

LENGTH	=	7000	[Ft]
AVE. SLOPE	=	0.75	[%]
ΔH = 182' - 130' = 52'			
AVE. VELOCITY	=	0.4	[Fps]

CHANNEL FLOW :

LENGTH	=	1800	[Ft]
AVE. SLOPE	=	0.66	[%]
ΔH = 130' - 118' = 12'			
AVE. VELOCITY	=	2.02	[Fps]

$$Tc = \left[\left(\frac{7000}{0.4}\right) + \left(\frac{1800}{2.02}\right)\right]\frac{1}{3600} = 4.86 + 0.25$$

$Tc = 5.1$ Hr.

2. ['Handbook of applied hydrology' by Chow, Pg 14-36]

$$Tc = \sqrt[2.14]{3/2\, L\eta / \sqrt{s}}$$

$$Tc = \sqrt[2.14]{\frac{3/2\,(7000 \times .4)}{\sqrt{0.0075}}}$$

Tc = time of concentration [min]
s = slope [%]
η = 0.4 roughness coefficient
L = length of overland flow [Ft]

$Tc = 106$ min

$Tc = 1.77 + 0.25 = \underline{2.0}$ Hr

3. [by, Design of small dams, Pg 71]

$$T_c = \left(\frac{11.9(L)^3}{H}\right)^{.385}$$

T_c = time of concentration [Hr]

L = Longerst water course [MI]

H = elev. difference [Ft]

$$T_c = \left(\frac{11.9(1.67)^3}{64}\right)^{.385}$$

$T_c = 0.95$ Hr.

L = 1.67 [MI]

H = 64 [Ft]

COMPUTER INPUT

T_c = 3.3 Hr. LAG = 60%

LAG Time = 2.0 Hr.

STORCH ENGINEERS

Sheet 4 of 12

Project 1132-06 SUNSHINE LAKE DAM Made By JHA Date 4-1-81

Chkd By JG Date 4/10/81

PRECIPITATION

24 HOURS, 100 YEAR RAINSTORM DISTRIBUTION

FOR SUNSHINE LAKE DAM

TIME [HR.]	RAIN [IN]
1	.08
2	.08
3	.08
4	.08
5	.08
6	.08
7	.09
8	.09
9	.18
10	.18
11	.18
12	.19
13	.30
14	.30
15	.50
16	3.00
17	.40
18	.30
19	.19
20	.18
21	.09
22	.09
23	.08
24	.08
24 [HR.]	7.2 [IN.]

FROM U.S. WEATHER BUREAU TP. 40

LAKE STORAGE VOLUME

W.L. ELEV. [Ft]	AREA [Acres]
110.0	0
118.0	9.2
120.0	18.4
130.0	41.8
140.0	90.5

HEC-1- DAM COMPUTER PROGRAM WILL DEVELOP STORAGE CAPACITY FROM WATER SURFACE AREAS & ELEVATIONS.

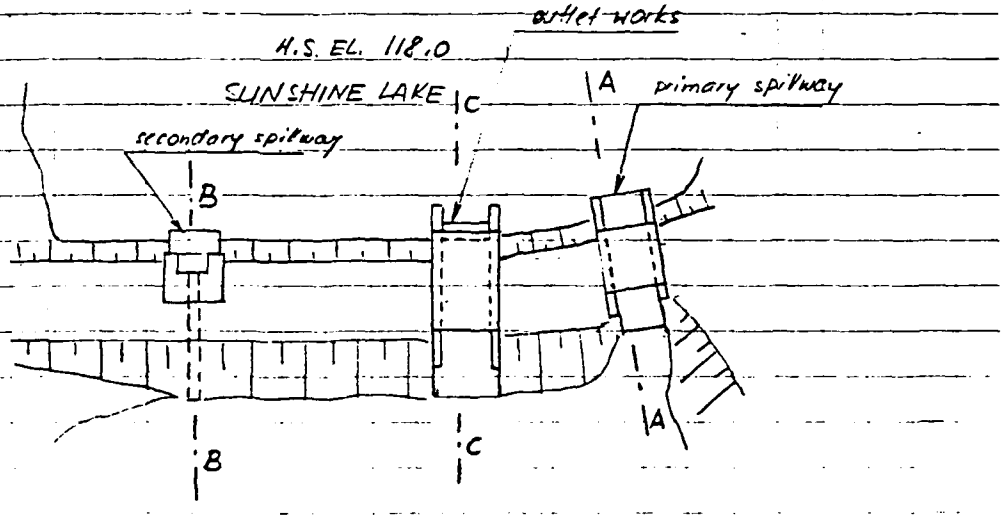
INFORMATION TAKEN FROM U.S.G.S. QUADRANGLE Clementon, N.J.

HYDRAULICS

SPILLWAY SECTION

THE SPILLWAY AT SUNSHINE LAKE DAM CONSISTS OF A PRIMARY SPILLWAY AT ELEV. 117.8 FEET, A SECONDARY SPILLWAY AT ELEV. 118.0 FEET & AN OUTLET WORKS AT ELEV. 118.2 FEET

PLAN



DISCHARGE CALCULATION

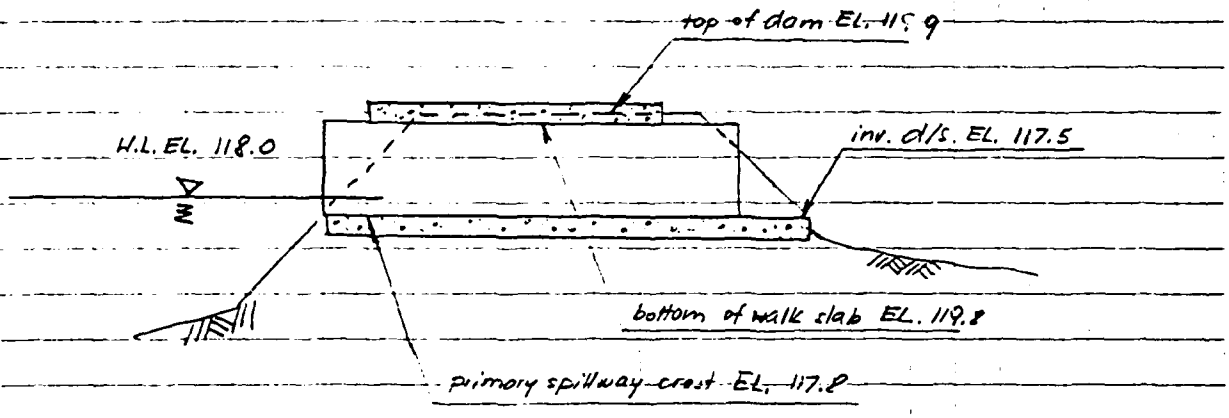
[SHC - Highway culverts, pg E-21]

THE DISCHARGE CAPACITY OF PRIMARY SPILLWAY AT ELEV. 117.8 FEET WILL BE BASED ON HYDRAULIC

CHARTS FOR THE SELECTION OF HIGHWAY CULVERTS, ASSUMING INLET CONTROL

FOR BOX CULVERT 2'x4'

ELEVATION SECTION A-A (PRIMARY SPILLWAY)



[Handbook of hydraulics, pg 5-9]

THE DISCHARGE CAPACITY OF SECONDARY SPILLWAY AT ELEV. 118.0 FEET WILL BE CALCULATED FROM ELEV. 118.0 FEET TO ELEV. 119.6 FEET USING FORMULA

$Q = C L H^{3/2}$

Q - discharge [cfs]
C - coefficient of discharge
L - eff. length of spillway [FT]
H - total head on spillway [FT]

FROM ELEV. 119.6 FEET AND ABOVE USING FORMULA FOR ORIFICE

STORCH ENGINEERS

Sheet 8 of 12

Project 1132 - 06 SUNSHINE LAKE DAM Made By JHO Date 4-2-81

Chkd By JG Date 4/10/81

[Handbook of hydraulics, Pg 4-10]

$Q = Ca\sqrt{2gh}$

Q - discharge [cfs]

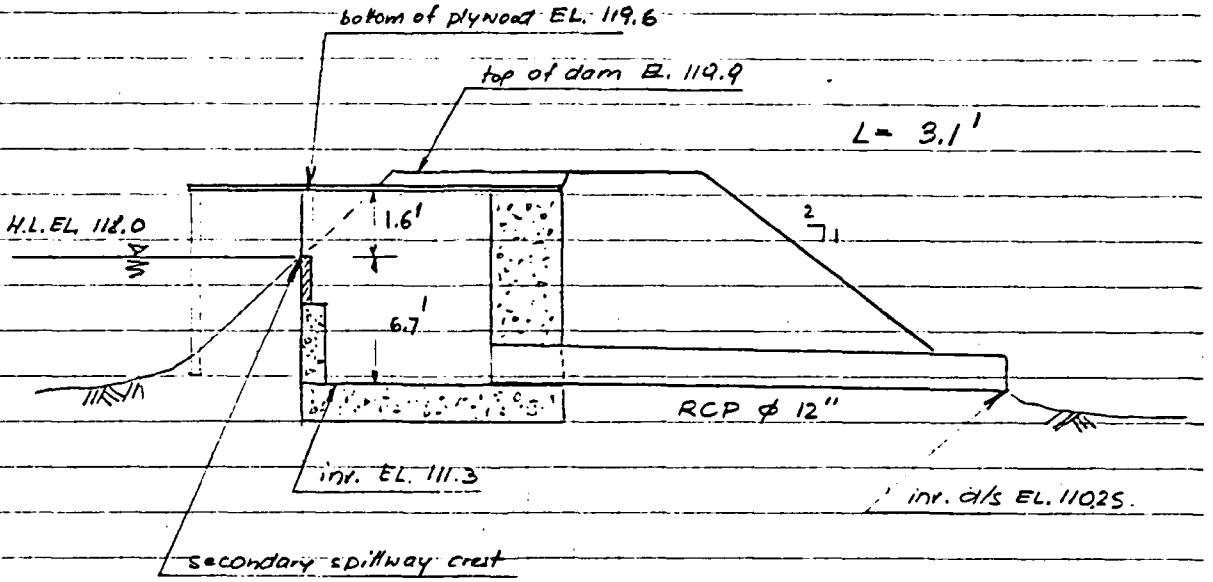
C - coefficient of discharge

a - area of discharge [Ft²]

g - 32.2

h - head to centroid [Ft]

ELEVATION SECTION B-B (SECONDARY SPILLWAY)



[HK - Highway culverts, Pg 5-22]

THE DISCHARGE CAPACITY FOR RCP ϕ 12" WILL BE BASED ON HYDRAULIC CHARTS FOR THE SELECTION OF HIGHWAY CULVERTS, ASSUMING INLET CONTROL.

SECONDARY SPILLWAY DISCHARGE SHALL BE TAKEN AS WEIR, ORIFICE OR CULVERT FLOW, WHICHEVER CONTROLS.

THE DISCHARGE CAPACITY OF OUTLET WORKS AT ELEV. 118.2 FEET WILL BE CALCULATED FOR SHARP-CRESTED WEIR USING FORMULA

[Handbook of hydraulics, pg 5-9]

$Q = CLH^{3/2}$

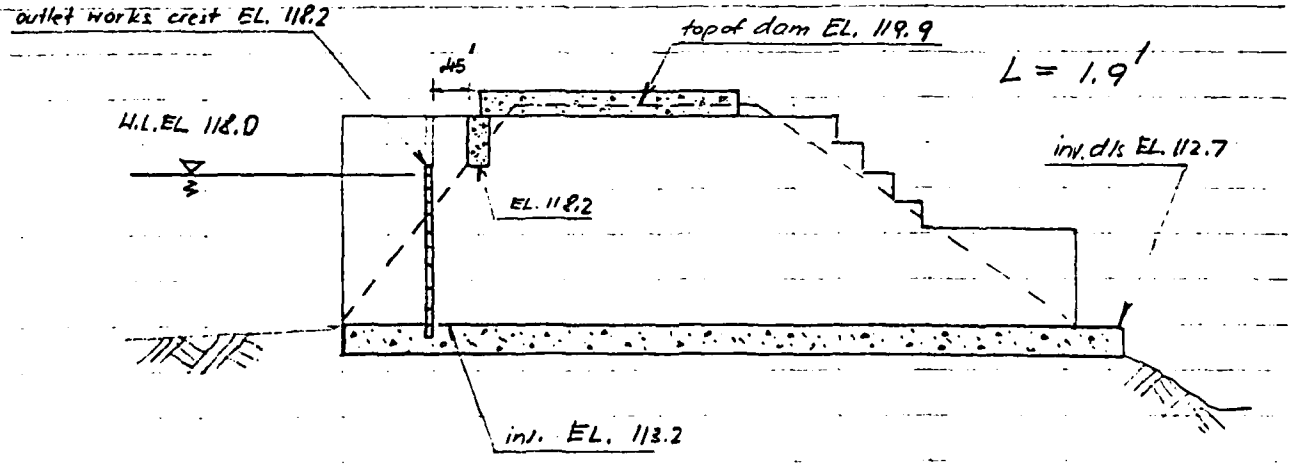
Q = discharge [cfs]
C = coefficient of discharge
L = length of spillway [Ft]
H = total head on spillway [Ft]

OR FOR A ORIFICE USING FORMULA

$Q = Ca\sqrt{2g\Delta h}$

Q = discharge [cfs]
C = coefficient of discharge
g = 32.2
a = area of discharge [Ft^2]
Δh = head over orifice [Ft]

ELEVATION SECTION C-C (OUTLET WORKS)



SPILLWAY DISCHARGE SHALL BE TAKEN AS WEIR OR ORIFICE FLOW, WHICHEVER CONTROLS.

STORCH ENGINEERS

Project 1132-06 SUNSHINE LAKE DAM Made By J.Ho Date 4-2-81 Sheet 10 of 12

Chkd By JG Date 4/10/81

SPILLWAY
STAGE DISCHARGE TABULATION

W.L. ELEV. [Ft]	PRIMARY SP. EL. 117.8 Box 2'x4' Chart 1 HW [Ft]	PRIMARY SP. Q1 [cfs]	SECONDARY SPILLWAY Weir L = 3.1' H [Ft]	C	Q [cfs]	Orifice d = 4.96[Ft²] C = .6 h [Ft]	Q [cfs]	EL. 118.0 RCP ϕ 12" Chart 2 EL. 111.3 HW [Ft]	Q [cfs]	Q2 [cfs]	OUTLET WORKS EL. 118.2 Weir L = 1.9' H [Ft]	C	Q [cfs]	Orifice a = .86[Ft²] C = .6 Δh [Ft]	Q [cfs]	Q3 [cfs]	Total Q [cfs]
117.8	—	—															—
118.0	.2	2	—	—	—			—	—	—							2
118.2	.4	3	.2	3.33	1			6.9	10	1	—	—	—	—	—	—	4
119.0	1.2	13	1.0	3.33	10	—	—	7.7	11	10	.8	3.33	4	.8	4	4	27
119.6	1.8	25	1.6	3.33	21	.8	21	8.3	12	12	1.4	3.33	11	1.4	5	5	42
119.9	2.1	31				1.1	25	8.6	12.5	12.5				1.7	5.5	5.5	49
120.5	2.7	40						9.2	13	13				2.3	6.5	6.5	59.5
121.0	3.2	48						9.7	13.5	13.5				2.8	7	7	68.5
121.5	3.7	56						10.2	14	14				3.3	7.5	7.5	77.5

STORCH ENGINEERS

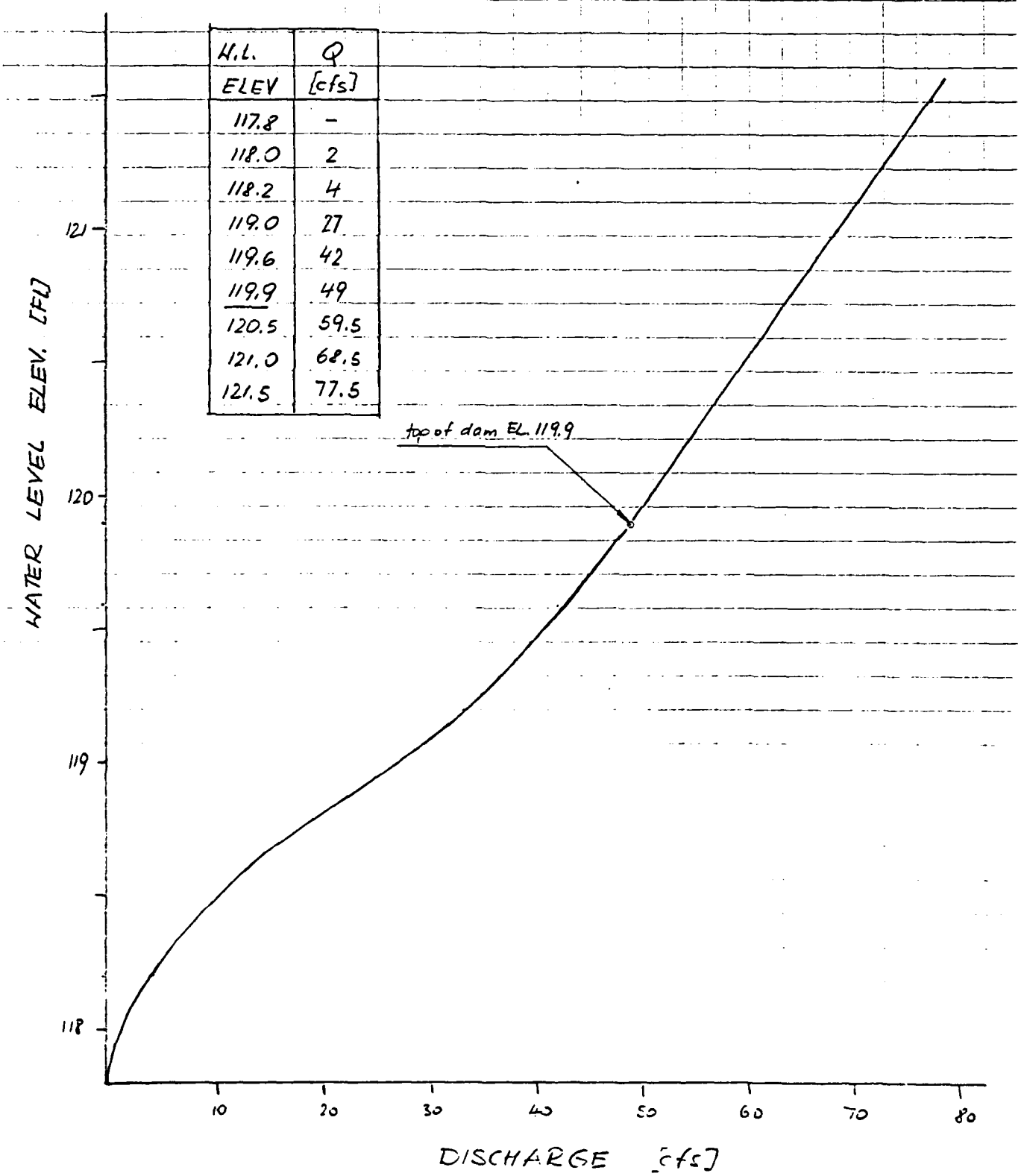
Sheet 11 of 12

Project 1132-06 SUNSHINE LAKE DAM Made By J.HG Date 4-2-81

Chkd By JG Date 4/10/81

SPILLWAY STAGE DISCHARGE CURVE

H.L. ELEV	Q [cfs]
117.8	-
118.0	2
118.2	4
119.0	27
119.6	42
119.9	49
120.5	59.5
121.0	68.5
121.5	77.5



STORCH ENGINEERS

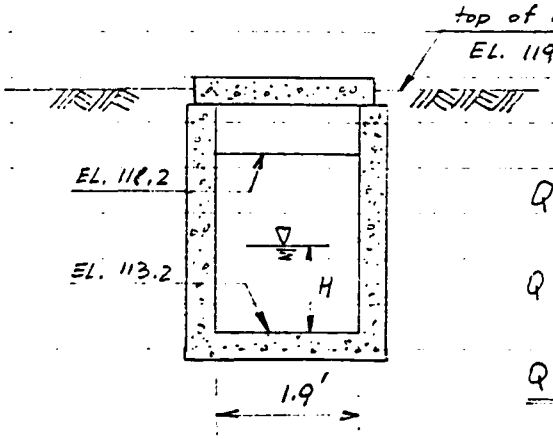
Sheet 12 of 12

Project 1132-06 SUNSHINE LAKE DAM Made By JHn Date 4-2-81

Chkd By JG Date 4/10/81

DRAWDOWN

THE DISCHARGE FOR DRAWDOWN WILL BE CALCULATED ON OUTLET WORKS BY ASSUMING WEIR FLOW OVER STOPLOGS AS THE ARE REMOVED. FOR AVERAGE DISCHARGE, ASSUME $H = 2.5'$. THE WEIR IS A SHARP CRESTED WITH LENGTH $1.9'$ AND $C = 3.32$



$Q = CLH^{3/2}$ Q = discharge [cfs]

C = coefficient

$Q = 3.32 \times 1.9 \times 2.5^{1.5}$ L = length of spillway [Ft.]

H = head on spillway [Ft.]

$Q = 25$ cfs

TIME OF DRAWDOWN

$$T_d = \frac{\text{Storge [Ac ft.]}}{\text{Ave. discharge} - \text{Ave. inflow [cfs]}}$$

Assume inflow = 4 cfs

$$T_d = \frac{23}{25 - 4} \times \frac{43560}{3600} = 13.3 \text{ Hr}$$

HEC - 1 - DAM PRINTOUT

Overtopping Analysis

```
1A1                    NATIONAL DAM SAFETY PROGRAM
A2                     SUNSHINE LAKE DAM, NEW JERSEY
A3                     100 YEAR STORM ROUTING
B     300       0      15                                  0       0       4
B1      5
J       1       1       1
J1      1
K       0    LAKE                        0       0       1
K1                 INFLOW HYDROGRAPH TO SUNSHINE LAKE DAM
M       0       2     1.9                 1.9                             1
O      96
O1  0.019   0.019   0.019   0.019   0.019   0.019   0.019   0.019   0.019   0.019
O1  0.019   0.019   0.019   0.019   0.019   0.019   0.019   0.019   0.019   0.019
O1  0.019   0.019   0.019   0.019   0.019   0.019   0.019   0.019   0.019   0.019
O1  0.019   0.019   0.019   0.019   0.019   0.019   0.019   0.019   0.019   0.019
O1  0.019   0.019   0.019   0.019   0.019   0.019   0.019   0.019   0.038   0.038
O1  0.038   0.038   0.038   0.038   0.038   0.038   0.038   0.038   0.038   0.038
O1  0.083   0.083   0.083   0.083   0.163   0.163   0.163   0.163   0.750   0.750
O1  0.750   0.750   0.163   0.163   0.163   0.163   0.083   0.083   0.083   0.083
O1  0.083   0.083   0.083   0.083   0.038   0.038   0.038   0.038   0.038   0.038
O1  0.038   0.038   0.038   0.038   0.038   0.038
T                                                   1.5    0.15
W2              2.0
X    -1.0   -0.05     2.0
N       1    DAM
K1                 ROUTE DISCHARGE THROUGH DAM
Y                                   1       1
Y1      1                                           -118.0    -1
Y4  117.8   118.0   118.2   119.0   119.6   119.9   120.5   121.0   121.5
Y5      0       2       4      27      42      49    59.5    68.5    77.5
$A      0     9.2    18.4    41.8    90.5
$E    110     118     120     130     140
$$  117.8
$D  119.9    2.63     1.5     400
K      99
```

NATIONAL DAM SAFETY PROGRAM
SUNSHINE LAKE DAM, NEW JERSEY
100 YEAR STORM ROUTING

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	15	0	0	0	0	0	4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 1 LRTIO= 1

RTIOS= 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH TO SUNSHINE LAKE DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
LAKE	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	2	1.90	0.00	1.90	0.00	0.000	0	1	0

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.50	.15	0.00	0.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= 2.00

RECESSION DATA
STRTQ= -1.00 QRCSN= -.05 RTIOR= 2.00

0
END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	7.12	4.33	2.79	21963.
										(181.)(110.)(71.)(			621.92)

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE DISCHARGE THROUGH DAM

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM	1	0	0	0	0	0	0	0

ROUTING DATA

OLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-118.	-1

STAGE	117.80	118.00	118.20	119.00	119.60	119.90	120.50	121.00	121.50
FLOW	0.00	2.00	4.00	27.00	42.00	49.00	59.50	68.50	77.50
SURFACE AREA=	0.	9.	18.	42.	91.				
CAPACITY=	0.	25.	52.	345.	991.				
ELEVATION=	110.	118.	120.	130.	140.				

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
117.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
119.9	2.6	1.5	400.

PEAK OUTFLOW IS 1473. AT TIME 19.75 HOURS

********** ********** ********** ********** **********

1

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1
				1.00
HYDROGRAPH AT	LAKE	1.90	1	1479.
		(4.92)		(41.89)(
ROUTED TO	DAM	1.90	1	1473.
		(4.92)		(41.70)(

1 SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	118.00	117.80	119.90
STORAGE	25.	23.	50.
OUTFLOW	2.	0.	49.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	121.11	1.21	73.	1473.	9.25	19.75	0.00

APPENDIX 5

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